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An empirical study to determine the relationship between food purchasing modes and obesity: Online vs physical

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***Abstract*---**The present world is dealing with very high levels of obesity across various regions. There is a total of 38.9 per cent of the population in the world who are suffering from obesity or overweight. In this study, the main focus is to understand the relationship existing among the food purchasing modes and obesity through the means of empirical evidence. The study would put forward the important aspects that can be associated with this relationship and provide further insight into the situation. A quantitative approach is followed where a total of 250 responses are collected to statistically analyse the objectives in hand. It is found that the majority prefer a mixture of both online and offline options when it comes to purchasing in general or even food products. But in the case of other products, the number of respondents preferring the online mode is higher as compared to the specified case of purchase of food products. It is also found that the majority of the female respondents are normal weight category while the majority of the male respondents are overweight category. Similarly, in the case of food habits followed by the respondents, it is found that the majority of the overweight respondents fall into the non-vegetarian category and the majority of the normal weight respondents falls into the vegetarian category. The study as a whole have managed to set up a relationship between that of the purchase modes preferred when shopping and the obesity or overweight levels being identified in individuals.

***Keywords*---**Obesity, Overweight, Purchase, Modes, Online.

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Introduction

The present-day individuals are highly motivated towards leading a healthy life. The beginning of 2020 saw the beginning of a long-term pandemic i.e., Covid-19 and this led to the consumers being more aware about their food purchasing and consuming habits. However, it is found through literature that there is a total of 38.9 percent of the population in the world who are suffering from obesity or overweight (Elflein, 2022). This number differs from country to country but the highest amount of the problem can be found in the United States of America. The World Health Organisation have published a number of facts across the world about the spread of obesity. The number of individuals suffering from obesity have tripled all over since the year 1975. The majority of the people across countries can be found to die because of being overweight as compared to that of being underweight. The definition of obesity can be stated as the accumulation of excessive fat in the body which is abnormal in nature and have an impact on health (WHO, 2021). The measurement for obesity is done using the Body Mass Index or popularly known as BMI and it is calculated by dividing the weight of the individual by the square of their height measured in meters. In the case of adults, a score of BMI being greater than or equal to 25 is considered obese while for children a standard of 30 is taken for measuring obesity. These changes in health have mostly occurred due to the changes taking place in terms of dietary options of individuals (Vandevijvere et al., 2015). The food products being offered in the market includes a number of low nutritional value ingredients. The choices made in the consumption of food often depend on a number of situational factors such as the culture, the environment and also on price (Contreras-Rodriguez et al., 2020). The intake of food having high levels of fat concentration and sugar levels encourages the overweight generation in individuals. Moreover, the situation is often worsened by the lack of physical activity in the lifestyle of individuals in today's world due to their nature of work. Although the concerns of obesity all over the world are genuine, the situation is cited by the majority of sources as preventable. A large section of its ability depends on the food consuming and purchasing habits formulated by individuals all across. In this study the main focus is to understand the relationship existing among the food purchasing modes and obesity through the means of empirical pieces of evidence. The study would put forward the important aspects that can be associated with this relationship and provide further insight into the situation.

Review of Literature

The above section provided an overall idea about the concept of obesity, its current situation and the amount of influence that food can cause. Before identifying the specific objectives of the study, a detailed review of the present body of literature is conducted.

(Mahomadbeigi et al., 2018) in their study included 300 students for anthropometric measurements and found that the consumption of fast food does not have any relationship with general obesity but is related to causing abdominal obesity. On the other hand, (Ho et al., 2016)found that snacking played a very important role in forming obesity in adolescents. The study showed the existence of a relationship among that between BMI and snacking habits of the

respondents. (da Luz et al., 2017) also focused on the presence of unhealthy eating habits amongst the respondents who are overweight or obese in nature. The presence of certain dysfunctional cognition often leads to the respondents undertaking unhealthy eating habits. (Gibson & Sainsbury, 2017) conducted their research to observe the impact of various diet plans on the reduction of the situation of obesity among the individuals. The results from the study does highlight that different kind of diets do cause a long term or short terms impact in the weight management practices among the obese respondents. (Coffino et al., 2020) presented their study to determine if having online grocery shopping habits can actually help individuals to follow a more nutritional diet. The study included the idea of a prefilled cart with required grocery items and how it can have an impact on dealing with food insecurities. The study did find a significant association between the two and reported that having a prefilled cart online can reduce insecurities with food. (Hu et al., 2020) also focused on conducting a longitudinal study to find out relationships between the food purchasing platform used and weight reduction capacities. The study found that the applications online which does have the provision of personalized nutrition recommendation facilities can have a meaningful impact in the weight loss of individuals dealing with obesity. (Demmler et al., 2018) explored the role played by supermarket shopping on that of deriving nutritional outcomes for individuals having obesity. The study shows that retail environments does cause an impact on the choices made by individuals in terms of food and there are various methods which can be used to encourage the intake of nutritional food through supermarket policies.

The above literature has revealed that there exists a high level of association between the food purchasing modes of the consumers and the obesity rate. In the present world due to the facility of online mode of shopping are being provided to the consumers, there are a number of food items that are purchased by the individuals even if they do not require them. Therefore, in such a situation it becomes important to find out the similarities or differences existing among food purchases made through the online or offline mode with that of the obesity levels. The following objectives are set for the study:

- To investigate the purchasing mode of online and offline consumers
- To determine the relationship existing among the purchasing mode and obesity levels observed amongst the consumers.

Research Methodology

The research methodology forms an integral part of any study as it helps in conducting the study systematically and scientifically. In this study, the quantitative approach is employed where primary data would be collected from the respondents to arrive at the results of the study. The study includes a structured questionnaire that has been designed by reviewing previous literature. For collecting data respondents from both genders would be approached who fall within the age group of 29-45 years. However, any respondent within the age group having any kind of cardiovascular disease, liver disease, Respiratory Disease, etc. would not be included in the samples. The study would use a purposive sampling method to choose the respondents and along with the questionnaire, a food frequency-based survey observation would also be done. A

total of 250 samples have been gathered for this study and statistical measures such as cross-tabulation, t-tests and ANOVA, have been used.

Data Analysis & Interpretation

The data have been gathered and analyzed using the Statistical Packages for Social Sciences. The demographic composition of respondents generates certain important insights about the study in hand. The demographics of the collected data are represented in Table - 1.

Table 1
Demographic representation

Demographic Variable	Frequency	Percentage
Gender		
Male	158	63.2
Female	92	36.8
Food Habit		
Vegetarian	86	34.4
Non-Vegetarian	110	44.0
Eggetarian	54	21.6
Education Level		
Professional Degree	141	56.4
Graduate	99	39.6
Intermediate/Diploma	10	4.0
Occupation		
Professionals	187	74.8
Semi-Professionals	18	7.2
Clerical/Shop/Farm	2	0.8
Skilled Worker	5	2.0
Unemployed/Students	38	15.2
Marital Status		
Married	105	42.0
Unmarried	145	58.0
Socio-economic Class		
Upper Class	173	69.2
Upper Middle Class	45	18.0
Lower Middle Class	8	3.2
Upper Lower Class	24	9.6

From Table – 1, it can be found that the respondents enquired for the study includes those from a variety of demographic representation. They belong to the various socio-economic class of the society who includes both employed individuals and students.

The study along includes a number of measures which detects their BMI value which can be used to determine the levels of obesity in the respondents.

Table 2
Descriptives of BMI values

	Height (in cm)	Weight (in Kg)	BMI Range
N	250	250	250
Mean	167	70.6	25.3
Median	168	70.5	24.9
Standard deviation	9.10	13.2	4.10
Minimum	144	43.0	16.1
Maximum	183	108	36.5

From Table – 2, The descriptives of the height, weight and BMI measures show that the mean of the height of the respondents is 167 cm, weight is 70.6 kgs and the average BMI range is 25.3. This shows that the majority of the respondents are in the levels of overweight as per the criteria provided by WHO.

Table 3
Frequencies of Category

Levels	Counts	% of Total	Cumulative %
Normal Weight	120	48.0 %	48.0 %
Obese Grade 1	9	3.6 %	51.6 %
Obese Grade 2	15	6.0 %	57.6 %
Overweight	99	39.6 %	97.2 %
Underweight	7	2.8 %	100.0 %

Table – 3 shows that the category of these respondents, it is found that 120 of the 250 respondents categorise themselves in the normal category, 9 in the obese grade 1 level, 15 in obese grade 2, 99 in the overweight range and 7 are underweight. A total of 49.2% of the respondents fall in the overweight/obese category. The respondents have been enquired about the number of days they prefer to do physical activity in a week and the responses are as follows-

Table 4
Frequencies of - Number of days you do physical activity per week

Levels	Counts	% of Total	Cumulative %
(1) - None	31	12.4 %	12.4 %
(2) - 1 to 2 days	47	18.8 %	31.2 %
(3) - 3 to 4 days	66	26.4 %	57.6 %
(4) - 5 to 6 days	60	24.0 %	81.6 %
(5) - Everyday	46	18.4 %	100.0 %

The results of Table – 4 shows that most of them prefer doing physical activities 3 to 4 days in a week. In Table – 5, The most common form of physical activity reported by the respondents includes walking (41.6%) followed by gym and yoga.

Table 5
Frequencies of particular physical activity done by the participants daily

Levels	Counts	% of Total	Cumulative %
(1) - Walk	104	41.6 %	41.6 %
(2) - Gym	44	17.6 %	59.2 %
(3) - Yoga	35	14.0 %	73.2 %
(4) - Exercise	31	12.4 %	85.6 %
(5) - None of them	36	14.4 %	100.0 %

Table 6
Descriptives of consumption patterns

	FFQ Cal	Energy (Kcal)	Protein (g)	Fat (g)	Carbohydrate (g)
N	250	250	250	250	250
Mean	1673	1445	61.6	53.4	197
Median	1677	1430	59.5	37.0	199
Standard deviation	309	323	20.3	55.7	67.1
Minimum	1098	708	23.0	5.00	28.1
Maximum	2405	2115	106	298	322

In Table – 6, The consumption of the respondents from the food frequency questionnaire constructed shows that the mean score for the FFQ is 1673 calories, the energy consumption is 1445 Kcal, Protein consumption is 61.6 grams, Fat is 53.4 grams and carbohydrate is 197 grams.

Table 7
Frequencies - Which mode of purchase do you prefer most of the time

Levels	Counts	% of Total	Cumulative %
(1) - Online mode	100	40.0 %	40.0 %
(2) - Offline mode	28	11.2 %	51.2 %
(3) – Both	122	48.8 %	100.0 %

Table 8
Frequencies - Your most preferred mode of shopping for food items

Levels	Counts	% of Total	Cumulative %
(1) - Online mode	63	25.2 %	25.2 %
(2) - Offline mode	86	34.4 %	59.6 %
(3) - Both	99	39.6 %	99.2 %
(4) - Neither	2	0.8 %	100.0 %

In Table – 7, On being enquired about the mode of purchase preferred by the respondents it is found that majority of them prefer both modes (48.8%) while more respondents prefer online mode of purchase than that of the offline modes. In Table – 8, When the question is asked for the shopping of food items especially, it is found that 39.6% prefer both but interestingly 34.4% prefer offline mode compared to 25.2% preferring online mode. In order to identify if there exists any relationship between the preference of the purchase mode with that of the BMI and FFQ consumptions, One Way ANOVA tests is conducted.

Table 9
One-Way ANOVA – Preferred mode of Purchase

	F	df1	df2	p
BMI Range	3.415	2	73.9	0.038
FFQ Cal	1.093	2	78.0	0.340
Energy (Kcal)	1.098	2	80.9	0.338
Protein (g)	0.357	2	103.0	0.701
Fat (g)	4.989	2	65.0	0.010

Table 9
One-Way ANOVA – Preferred mode of Purchase

	F	df1	df2	p
Carbohydrate (g)	3.075	2	70.5	0.052

Table 10
One-Way ANOVA – Preferred mode of Purchase for Food Products

	x^2	df	p
BMI Range	2.208	3	0.530
FFQ Cal	4.792	3	0.188
Energy (Kcal)	3.396	3	0.334
Protein (g)	7.584	3	0.055
Fat (g)	11.697	3	0.008
Carbohydrate (g)	0.751	3	0.861

In Table – 9, The analysis conducted using the measures showed that there are significant relationships between the preferred mode of purchase in general and the BMI range and the Fat consumption. In Table – 10, On the other hand, in terms of the most preferred mode for purchase of food products showed no relationship with BMI but are significant in terms of Fat consumption.

In order to analyse the situation in detail, the demographic associations are enquired with respect to important factors in question.

Table 11a
Independent Samples T-Test- Gender-BMI

		Statistic	df	p
BMI Range	Student's t	3.05	248	0.003

Table 11b
Independent Samples T-Test- Marital Status-BMI

		Statistic	df	p
BMI Range	Student's t	-1.85	248	0.065

In Table – 11a - For the two factors with two levels of categories, it is found that the BMI range of the respondents has a significant association with the gender of the individuals. In Table – 11b On the other hand, the marital status does not significantly differentiate the BMI range of the respondents.

Table 12
Cross Tabulation Table

	Gender		
Category	(1) Male	(2) Female	Total
Normal Weight	60	60	120
Obese Grade 1	9	0	9
Obese Grade 2	10	5	15
Overweight	72	27	99
Underweight	7	0	7
Total	158	92	250

Table 13
Kruskal-Wallis- Food Habit- BMI

	x^2	df	p
BMI Range	8.62	2	0.013

Under Table – 13, Conducting One Way ANOVA for the demographic variables having more than two categories, it is found that only the food habit of the respondents have a significant association with the BMI range of the individuals. In order to determine the exact levels of difference, pairwise comparison is conducted.

Table 14
Kruskal-Wallis- Income- BMI

	x^2	df	p
BMI Range	4.10	2	0.129

Table 15
Kruskal-Wallis- Occupation- BMI

	x^2	df	p
BMI Range	5.90	4	0.207

Table 16
Kruskal-Wallis- Socio-Economic Class- BMI

	x^2	df	p
BMI Range	2.79	3	0.426

Table 17
Pairwise comparisons - BMI Range

		W	p
(1) Vegetarian	(2) Eggetarian	2.68	0.141
(1) Vegetarian	(3) Non - Vegetarian	3.96	0.014
(2) Eggetarian	(3) Non - Vegetarian	1.20	0.672

Table 18
Contingency Tables

	Food Habit			
Category	(1) Vegetarian	(2) Eggetarian	(3) Non - Vegetarian	Total
Normal Weight	53	29	38	120
Obese Grade 1	5	0	4	9
Obese Grade 2	0	5	10	15
Overweight	28	20	51	99
Underweight	0	0	7	7
Total	86	54	110	250

In Table – 12, The respondents have been divided into various categories based on their BMI levels. Table – 18, A cross-tabulation is provided based on the category of the respondent and the food habit preferred by them. Table – 17, The

comparison conducted interestingly shows that, it is the difference between the vegetarian and the non-vegetarian food habits of the individuals that impact on the different BMI ranges attained by the individuals. The analysis conducted with the means of various statistical tools has allowed achieving the objectives of the study and providing a clear picture of the present situation with respect to obesity and purchase modes.

The main purpose of the study has been to understand the situation with respect to the preference made by respondents regarding the usage of online or offline shopping modes, especially in the case of food products. The study focused on determining if there exists any significant influence of these purchase modes being preferred of participants according to the obesity category. The data collected from 250 respondents showed that the majority of them consisted of a BMI score of more than 25 indicating the presence of obesity or overweight issues among these respondents. The two objectives in the study have been analyzed using the appropriate statistical tools and it is found that there are certain important observations to be noted in terms of the relationship existing between these two aspects. In the first objective, the online and offline preferences of the purchase modes of the respondents are enquired. It is found that the majority prefer a mixture of both online and offline options when it comes to purchasing in general or even food products. But in the case of other products, the number of respondents preferring the online mode is higher as compared to the specified case of purchase of food products. There are certain additional questions that have been asked to the respondents as a part of the questionnaire and it is found that there exists a nominal amount of physical activity among the respondents in a weekly basis. The majority of them prefer to walk followed by going to the gym and doing yoga. However, as a part of the second objective, when the purchase mode preferences of the respondents are enquired with respect to the BMI range of the individuals, it is found that in case of their overall preference of purchase modes for shopping any product, there is a significant impact with the BMI range but when the food products are specified, there is no such association found. This could have a direct relationship with the amount of physical activity being lost due to the use of online modes of purchasing and because of which there are substantial changes in the lifestyle of the individuals. The preference of an integrated method of overall purchase of the consumers shows that due to the inclusion of the online mode of purchases into the regular methods of shopping, there are some additional habits and lifestyles included. As there is no significant influence found in the case of purchase of food products, it can be stated that the amount of input made in this course still remains. The fat consumption levels among the respondents are found to be significantly associated with that of the purchase mode preferred which generates a clearer picture on how there exists a certain indirect relationship between the attainment of obesity or overweight by individuals and that of the purchase mode preferred by them. The study also found that there is a significant difference in the BMI range of individuals based on gender and the food habit followed by them. Conducting a cross-tabulation among the category of the respondent and their gender it is found that there are equal number of normal weight males and females but there are very high number of overweight males as compared to females. Similar is the case for the obese grade 1 and 2 respondents. It is found that the majority of the female respondents are normal weight category while the majority of the male

respondents are overweight category. Similarly, in case of food habits followed by the respondents, it is found that the majority of the overweight respondents fall into the non-vegetarian category and the majority of the normal weight respondents fall into the vegetarian category.

Conclusion

The study as a whole have managed to set up a relationship between that of the purchase modes preferred when shopping and the obesity or overweight levels being identified in individuals. The study provides empirical pieces of evidence on the same and in the future, there can be various health-based strategies adopted to solve the issues faced by overweight or obese individuals. The study can be further conducted across other geographical domains and make the base of the research in the field even stronger.

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